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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
MARTINEZ, BRITTANY M	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/593,918	TOUR ET AL.	
	Examiner	Art Unit	
	BRITTANY M. MARTINEZ	1734	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 February 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 7-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5 and 7-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 February 2011* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicants' submission filed on February 4, 2011, has been entered.

Status of Application

Acknowledgment is made of Applicants' arguments/remarks and amendments filed February 4, 2011. **Claims 1-5 and 7-32** are pending in the instant application, with **Claims 1, 16 and 27** amended. **Claim 6** has been cancelled. **Claims 1-5 and 7-32** have been examined.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. **Claim 1** is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

3. The portion of **Claim 1** that reads "wherein the acid solvent is selected from the group consisting of a superacid and an oxoacid further comprising a persulfate species" renders the claim indefinite because it is unclear whether "further comprising a persulfate species" was intended to limit both the superacid and the oxoacid (i.e. wherein the acid solvent is selected from the group consisting of a superacid and an oxoacid, and wherein the acid solvent further comprises a persulfate species) or just the oxoacid. For purposes of examination, "wherein the acid solvent is selected from the group consisting of a superacid and an oxoacid further comprising a persulfate species" was interpreted to mean the persulfate species only further limits the oxoacid.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. **Claims 1-3, 5, 7-10, 12, 13, 15-17, 19, 20, 24, 28 and 30-32** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Smalley et al. (WO 03/004741 A1).

8. With regard to **Claims 1, 2, 7-10, 16 and 32**, Bahr discloses dispersing single-wall carbon nanotubes in a solvent to form a solution of dispersed single-wall carbon nanotubes; adding a functionalizing agent (aryl diazonium tetrafluoroborate salts or diazonium generated in situ by reacting an alkyl nitrite with an aniline derivative) to the solution; and functionalizing the dispersed single-wall carbon nanotubes using the added functionalizing agent while the dispersed single-wall carbon nanotubes are in the solution; wherein the functionalizing comprises covalently attaching the added functionalizing agent to the sidewalls of the single-wall carbon nanotubes to form sidewall functionalized carbon nanotubes (Bahr, page 3823; page 3824, 1st column, last paragraph-second column; Figure 1, in particular). The difference between the process of Bahr and that of **Claim 1** is Bahr does not disclose an acid solvent selected from the group consisting of a superacid and an oxoacid further comprising a persulfate species.

The difference between the process of Bahr and that of **Claim 16** is Bahr does not disclose a superacid solvent.

9. With regard to **Claim 12**, Bahr discloses post-processing the sidewall functionalized carbon nanotubes by diluting, filtering and washing (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

10. With regard to **Claim 13**, Bahr discloses isolating the sidewall functionalized carbon nanotubes from the solution by filtering to yield isolated sidewall functionalized carbon nanotubes; and re-suspending the isolated sidewall functionalized carbon nanotubes in a solvent (DMF) (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

11. With regard to **Claims 15 and 28**, Bahr discloses the functionalized single-wall carbon nanotubes having an estimated 1 in 37 carbons in the single-wall carbon nanotubes being functionalized (Bahr, page 3824, 2nd column, 1st paragraph, in particular).

12. With regard to **Claim 17**, Bahr discloses oxidatively purifying the single-wall carbon nanotubes prior to dispersing (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

13. With regard to **Claim 19**, Bahr discloses filtering the dispersion over a PTFE (0.45 μM) membrane (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

14. With regard to **Claim 24**, Bahr discloses reacting the single-wall carbon nanotubes with the diazonium species comprising heating and stirring the dispersion (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

15. Bahr does not disclose a superacid solvent selected from the group consisting of oleum, chlorosulfonic acid, triflic acid, and combinations thereof (**Claims 3 and 20**); an acid solvent comprising H_2SO_4 (**Claim 5**); or the sidewall functionalized single-wall carbon nanotubes being water soluble (**Claims 30 and 31**).

16. With regard to **Claims 1, 3, 5, 16 and 20**, Smalley discloses dispersing single-wall carbon nanotubes in an acid solvent to form a solution of dispersed carbon nanotubes having substantially exposed sidewalls (Smalley, page 10, lines 17-26; page 11, lines 11-17, in particular), wherein the acid solvent is selected from the group consisting of a superacid (oleum, chlorosulfonic acid, triflic acid, and combinations thereof) and an oxoacid (H_2SO_4, $HClO_4$, and combinations thereof) (Smalley, page 4, lines 11-12; page 6, lines 18-39; page 7, lines 1-20, in particular). Smalley further discloses the well-known difficulties in obtaining a uniform dispersion of single-wall carbon nanotubes (Smalley, page 2, in particular). Smalley discloses that

> "[t]he largest complication in dispersing single-wall carbon nanotubes is their propensity to tightly self-associate with each other. When single-wall carbon nanotubes come in close contact with each other, they tend to become tightly bound by van der Waals forces, which act to hold the nanotubes tightly together as "ropes" of aligned bundles of a few to many hundreds of nanotubes. Besides this ordered roping alignment, there is also significant disordered entanglement when many of the single-wall carbon nanotubes and ropes of single-wall carbon nanotubes contact each other randomly during synthesis, external compression and/or subsequent purification. These randomly oriented, entangled mats of individual single-wall carbon nanotubes and ropes of single-wall carbon nanotubes are very difficult to disperse into other materials"
>
> (Smalley, page 2, lines 6-14).

"A related complication in dispersing single-wall carbon nanotubes is that due to their chemical composition and structure, the nanotubes are generally quite insoluble in liquids and other media. The nanotubes would generally tend to self-associate with each other through van der Waals interactions rather than disperse in other media.

The ability to disperse single-wall carbon nanotubes remains one of the largest barriers in realizing the full potential of single-wall carbon nanotubes in various applications"

(Smalley, page 2, lines 31-36).

17. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to modify the process of Bahr with the superacid solvent of Smalley in order to overcome the well-known difficulties in single-wall carbon nanotube dispersion (Smalley, page 2, in particular) and to obtain a process with enhanced single-wall carbon nanotube dispersion (Smalley, Abstract; page 12, lines 6-13, in particular).

18. While the aforementioned applied art does not explicitly disclose the sidewall functionalized single-wall carbon nanotubes being water soluble, the diazonium-functionalized single-wall carbon nanotubes of the aforementioned applied art would be water soluble to no less an extent than that of the instant application because the diazonium-functionalized single-wall carbon nanotubes of the aforementioned applied art are the same product (diazonium-functionalized single-wall carbon nanotubes) and produced by the same process as that of the instant application.

19. **Claims 4 and 5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Smalley et al. (WO 03/004741 A1) as applied to **Claim 1** above, and further in view of Niu et al. (US 7,070,753 B2).

20. With regard to **Claims 4 and 5**, Smalley discloses dispersing single-wall carbon nanotubes in an acid solvent to form a solution of dispersed carbon nanotubes having substantially exposed sidewalls (Smalley, page 10, lines 17-26; page 11, lines 11-17, in

particular), wherein the acid solvent is H_2SO_4, $HClO_4$, or combinations thereof (Smalley, page 4, lines 11-12; page 6, lines 18-39; page 7, lines 1-20, in particular).

21. The aforementioned applied art does not disclose the H_2SO_4, $HClO_4$, or combinations thereof further comprising a persulfate species (**Claim 1**).

22. With regard to **Claims 4 and 5**, Niu discloses a method comprising dispersing carbon nanotubes in a persulfate species to form dispersed carbon; and functionalizing the dispersed carbon nanotubes by covalently attaching functional groups to the sidewalls to yield sidewall functionalized carbon nanotubes (Niu, Abstract; Example 18; Claims 1 and 5-7, in particular). The process of Niu increases the degree of dispersion of carbon nanotubes and aids in disassembling carbon nanotube aggregates (Niu, Abstract, in particular).

23. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to modify the process of the aforementioned applied art with the persulfate species of Niu in order to obtain a dispersion of carbon nanotubes with a higher degree of dispersion (Niu, Abstract, in particular).

24. **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Smalley et al. (WO 03/004741 A1) as applied to **Claims 1 and 8** above, and further in view of Brase (*Acc. Chem. Res.*).

25. The aforementioned applied art does not disclose the diazonium species generated from a triazene precursor (**Claim 11**).

26. With regard to **Claim 11**, it is well-known in the art that triazene precursors are obvious variants of diazonium salts, as evidenced by Brase (Brase, page 806, 2nd column, “Triazenes as Linkers," in particular). Brase discloses that "Triazenes, which are protected diazonium ions,...are...quite robust, making them ideal precursors for diazonium salts" (Brase, page 806, 2nd column, “Triazenes as Linkers"). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to modify the process of the aforementioned applied art with the triazene precursors of Brase because one of ordinary skill in the art could have pursued the known potential diazonium species precursor options within his or her technical grasp with a reasonable expectation of success.

27. **Claims 14, 25 and 27** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Smalley et al. (WO 03/004741 A1) as applied to **Claims 1, 13 and 16** above, and further in view of Shibuta (US 5,853,877).

28. With regard to **Claims 14, 25 and 27**, Bahr discloses diluting the functionalized single-wall carbon nanotube suspension with DMF, filtering, washing extensively with DMF, repeated sonication in and further washing with DMF (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

29. The aforementioned applied art does not disclose the solvent being water (**Claim 14**); after reacting, diluting the dispersion with water (**Claim 25**); or after washing, re-suspending the functionalized single-wall carbon nanotubes in water (**Claim 27**).

30. With regard to **Claims 14, 25 and 27**, DMF and water are obvious variants in the art, as evidenced by Shibuta (Shibuta, Abstract; col. 4, lines 29-67; col. 5, lines 1-16 and 41-67; col. 6, lines 1-8, in particular). Shibuta discloses a process for dispersing and disentangling hollow carbon microfibers (outer diameter of 3.5 to 70 nm) by treating the hollow carbon microfibers with strong acids (sulfuric acid or superacids such as oleum, chlorosulfonic acid, triflic acid, and combinations thereof), wherein after the strong acid treatment, the hollow microfibers are recovered from the strong acid, filtered, washed and dispersed in a polar solution such as water, ketones, DMF, or combinations thereof (Shibuta, Abstract; col. 4, lines 29-67; col. 5, lines 1-16 and 41-67; col. 6, lines 1-8, in particular).

31. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to modify the process disclosed by the aforementioned applied art with the water solvent as taught by Shibuta because one of ordinary skill in the art could have pursued the known potential solvent options within his or her technical grasp with a reasonable expectation of success. Further, repeating process steps and varying the order of process steps is *prima facie* obvious.

32. **Claim 18** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Smalley et al. (WO 03/004741 A1) as applied to **Claim 16** above, and further in view of Chen et al. (US 6,723,299 B1).

33. The aforementioned applied art does not disclose the single-wall carbon nanotubes sorted by a property selected from the group consisting of length, diameter, chirality, and combinations thereof prior to dispersing (**Claim 18**).

34. With regard to **Claim 18**, it is well-known in the art to sort single-wall carbon nanotubes by a property such as length prior to dispersing, as evidenced by Chen (Chen, col. 3, lines 23-30, in particular). Chen discloses that shorter single-wall carbon nanotubes have a "rich chemistry due to their higher chemical processability" and are often sorted by length before functionalizing and solubilizing (Chen, col. 3, lines 23-30, in particular).

35. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to modify the process of the aforementioned applied art with the length separation of Chen because one of ordinary skill in the art could have pursued the known potential options for maximizing chemical processability within his or her technical grasp with a reasonable expectation of success.

36. **Claim 21** is rejected under 35 U.S.C. 103(a) as being obvious over Bahr et al. (*Chem. Mater.*) in view of Smalley et al. (WO 03/004741 A1) as applied to **Claim 16** above, and further in view of Yu et al. (US 6,399,202 B1).

37. The aforementioned applied art does not disclose the aniline species comprising sulfanilic acid. However, sulfanilic acid is a well-known aniline species used to produce diazonium species, as evidenced by Yu (Yu, Examples, in particular). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to

modify the process disclosed by the aforementioned applied art with the sulfanilic acid of Yu because one of ordinary skill in the art could have pursued the known potential aniline species used to produce diazonium species within his or her technical grasp with a reasonable expectation of success.

38. **Claims 22, 23 and 29** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Smalley et al. (WO 03/004741 A1) as applied to **Claims 1, 8 and 16** above, and further in view of Umek et al. (*Chem. Mater.*).

39. The aforementioned applied art does not disclose the superacid solvent further comprising a radical source (**Claims 22 and 29**) selected from 2,2'-*azo-bis*-isobutyrylnitrile, benzoyl peroxide, di-tert-butylperoxide, and combinations thereof (**Claim 23**).

40. With regard to **Claims 22, 23 and 29**, Umek discloses the functionalization of single-wall carbon nanotubes via addition of carbon radicals (benzoyl peroxide) in a dispersion (Umek, Abstract; page 4752, “Experimental Section” and “Results and Discussion;” Scheme 1, in particular).

41. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to modify the process of the aforementioned applied art with the carbon radical source of Umek in order to obtain a process capable of producing functionalized single-wall carbon nanotubes which exhibit better dispersability in organic solvents and

thus, easier incorporation into polymer matrices (Umek, page 4755, 2nd column, 2nd paragraph, in particular).

42. **Claim 26** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Smalley et al. (WO 03/004741 A1) and Shibuta (US 5,853,877) as applied to **Claim 25** above, and further in view of Smalley et al. (US 2002/0127171 A1).

43. With regard to **Claim 26**, Bahr discloses diluting the functionalized single-wall carbon nanotube suspension with DMF, filtering, washing extensively with DMF, repeated sonication in and further washing with DMF (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

44. With regard to **Claim 26**, Shibuta discloses a process for dispersing and disentangling hollow carbon microfibers (outer diameter of 3.5 to 70 nm) by treating the hollow carbon microfibers with strong acids (sulfuric acid or superacids such as oleum, chlorosulfonic acid, triflic acid, and combinations thereof), wherein after the strong acid treatment, the hollow microfibers are recovered from the strong acid, filtered, washed and dispersed in a polar solution such as water, ketones, DMF, or combinations thereof (Shibuta, Abstract; col. 4, lines 29-67; col. 5, lines 1-16 and 41-67; col. 6, lines 1-8, in particular).

45. The aforementioned applied art does not disclose the washing solvent being acetone (**Claim 26**).

46. With regard to **Claim 26**, acetone is a well-known ketone useful in washing single-wall carbon nanotubes, as evidenced by Smalley et al. (US 2002/0127171 A1) (Smalley et al. (US 2002/0127171 A1), paragraph 0040, in particular).

47. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to modify the process disclosed by the aforementioned applied art with the acetone washing solvent as taught by Smalley et al. (US 2002/0127171 A1) because one of ordinary skill in the art could have pursued the known potential ketone solvent options within his or her technical grasp with a reasonable expectation of success.

48. **Claims 1-3, 5, 7-10, 12, 13, 15-17, 19, 20, 24, 28 and 30-32** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Davis et al. (*Macromolecules*).

49. With regard to **Claims 1, 2, 7-10, 16 and 32**, Bahr is applied as above. The difference between the process of Bahr and that of **Claim 1** is Bahr does not disclose an acid solvent selected from the group consisting of a superacid and an oxoacid further comprising a persulfate species. The difference between the process of Bahr and that of **Claim 16** is Bahr does not disclose a superacid solvent.

50. With regard to **Claim 12**, Bahr discloses post-processing the sidewall functionalized carbon nanotubes by diluting, filtering and washing (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

51. With regard to **Claim 13**, Bahr discloses isolating the sidewall functionalized carbon nanotubes from the solution by filtering to yield isolated sidewall functionalized carbon nanotubes; and re-suspending the isolated sidewall functionalized carbon nanotubes in a solvent (DMF) (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

52. With regard to **Claims 15 and 28**, Bahr discloses the functionalized single-wall carbon nanotubes having an estimated 1 in 37 carbons in the single-wall carbon nanotubes being functionalized (Bahr, page 3824, 2nd column, 1st paragraph, in particular).

53. With regard to **Claim 17**, Bahr discloses oxidatively purifying the single-wall carbon nanotubes prior to dispersing (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

54. With regard to **Claim 19**, Bahr discloses filtering the dispersion over a PTFE (0.45 μM) membrane (which would remove any large particles) (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

55. With regard to **Claim 24**, Bahr discloses reacting the single-wall carbon nanotubes with the diazonium species comprising heating and stirring the dispersion (Bahr, page 3823, 2nd column, 2nd paragraph, in particular).

56. Bahr does not disclose a superacid solvent selected from the group consisting of oleum, chlorosulfonic acid, triflic acid, and combinations thereof (**Claims 3 and 20**); an acid solvent comprising H_2SO_4 (**Claim 5**); or the sidewall functionalized single-wall carbon nanotubes being water soluble (**Claims 30 and 31**).

57. With regard to **Claims 1, 3-5, 16 and 20**, Davis discloses single-walled carbon nanotubes can be dispersed at high concentrations in superacids such as oleum, chlorosulfonic acid, triflic acid, sulfuric acid, and combinations thereof (Davis, Abstract; page 154; page 159, "Conclusions," in particular). Davis discloses that "the lack of a liquid able to disperse significant amounts of pristine SWNTs has been the single most important roadblock to manufacturing macroscopic articles composed solely of SWNTs" (Davis, page 154, 1st column, 1st paragraph, in particular). However, SWNTs can be dispersed at concentrations up to 10 wt% in superacids, a concentration "over 10 times the highest concentration ever achieved with wrapping or stabilization by surfactants" (Davis, page 154, 1st column, 2nd paragraph, in particular). The high dispersed carbon nanotube concentration in superacids is due to the protonation of the sidewalls of the SWNTs, which eliminates wall-wall van der Waals interactions and promotes the dispersion process (Davis, Abstract; page 154, 1st column, 2nd paragraph – 2nd column, 1st paragraph, in particular). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to modify the process of Bahr with the superacid of Davis in order to obtain a process capable of achieving a high concentration of dispersed carbon nanotubes (Davis, Abstract; page 154, 1st column – 2nd column, 1st paragraph, in particular).

58. While the aforementioned applied art does not explicitly disclose the carbon nanotubes having substantially exposed sidewalls, the dispersion in superacid would produce carbon nanotubes having substantially exposed sidewalls to no less an extent than that of **Claim 1**. Thus, if the dispersion in superacid produces carbon nanotubes

having substantially exposed sidewalls, functionalizing the sidewalls would comprise covalently attaching functional groups to the substantially exposed sidewalls.

59. While the aforementioned applied art does not explicitly disclose the sidewall functionalized single-wall carbon nanotubes being water soluble, the diazonium-functionalized single-wall carbon nanotubes of the aforementioned applied art would be water soluble to no less an extent than that of the instant application because the diazonium-functionalized single-wall carbon nanotubes of the aforementioned applied art are the same product (diazonium-functionalized single-wall carbon nanotubes) and produced by the same process as that of the instant application.

60. **Claims 4 and 5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Davis et al. (*Macromolecules*) as applied to **Claim 1** above, and further in view of Niu et al. (US 7,070,753 B2).

61. With regard to **Claims 4 and 5**, Davis discloses single-walled carbon nanotubes can be dispersed at high concentrations in superacids such as oleum, chlorosulfonic acid, triflic acid, sulfuric acid, and combinations thereof (Davis, Abstract; page 154; page 159, “Conclusions,” in particular).

62. The aforementioned applied art does not disclose the H_2SO_4 further comprising a persulfate species (**Claim 1**).

63. With regard to **Claims 4 and 5**, Niu is applied as above.

64. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to modify the process of the aforementioned applied art with the persulfate

species of Niu in order to obtain a dispersion of carbon nanotubes with a higher degree of dispersion (Niu, Abstract, in particular).

65. **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Davis et al. (*Macromolecules*) as applied to **Claims 1 and 8** above, and further in view of Brase (*Acc. Chem. Res.*).

66. The aforementioned applied art does not disclose the diazonium species generated from a triazene precursor (**Claim 11**).

67. With regard to **Claim 11**, it is well-known in the art that triazene precursors are obvious variants of diazonium salts, as evidenced by Brase (Brase, page 806, 2nd column, “Triazenes as Linkers," in particular). Brase is applied as above. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to modify the process of the aforementioned applied art with the triazene precursors of Brase because one of ordinary skill in the art could have pursued the known potential diazonium species precursor options within his or her technical grasp with a reasonable expectation of success.

68. **Claims 14, 25 and 27** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Davis et al. (*Macromolecules*) as applied to **Claims 1, 13 and 16** above, and further in view of Shibuta (US 5,853,877).

69. With regard to **Claims 14, 25 and 27**, Bahr is applied as above.

70. The aforementioned applied art does not disclose the solvent being water (**Claim 14**); after reacting, diluting the dispersion with water (**Claim 25**); or after washing, re-suspending the functionalized single-wall carbon nanotubes in water (**Claim 27**).

71. With regard to **Claims 14, 25 and 27**, DMF and water are obvious variants in the art, as evidenced by Shibuta (Shibuta, Abstract; col. 4, lines 29-67; col. 5, lines 1-16 and 41-67; col. 6, lines 1-8, in particular). Shibuta is applied as above.

72. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to modify the process disclosed by the aforementioned applied art with the water solvent as taught by Shibuta because one of ordinary skill in the art could have pursued the known potential solvent options within his or her technical grasp with a reasonable expectation of success. Further, repeating process steps and varying the order of process steps is *prima facie* obvious.

73. **Claim 18** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Davis et al. (*Macromolecules*) as applied to **Claim 16** above, and further in view of Chen et al. (US 6,723,299 B1).

74. The aforementioned applied art does not disclose the single-wall carbon nanotubes sorted by a property selected from the group consisting of length, diameter, chirality, and combinations thereof prior to dispersing (**Claim 18**).

75. With regard to **Claim 18**, it is well-known in the art to sort single-wall carbon nanotubes by a property such as length prior to dispersing, as evidenced by Chen (Chen, col. 3, lines 23-30, in particular). Chen is applied as above.

76. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to modify the process of the aforementioned applied art with the length separation of Chen because one of ordinary skill in the art could have pursued the known potential options for maximizing chemical processability within his or her technical grasp with a reasonable expectation of success.

77. **Claim 21** is rejected under 35 U.S.C. 103(a) as being obvious over Bahr et al. (*Chem. Mater.*) in view of Davis et al. (*Macromolecules*) as applied to **Claim 16** above, and further in view of Yu et al. (US 6,399,202 B1).

78. The aforementioned applied art does not disclose the aniline species comprising sulfanilic acid. However, sulfanilic acid is a well-known aniline species used to produce diazonium species, as evidenced by Yu (Yu, Examples, in particular). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to modify the process disclosed by the aforementioned applied art with the sulfanilic acid of Yu because one of ordinary skill in the art could have pursued the known potential aniline species used to produce diazonium species within his or her technical grasp with a reasonable expectation of success.

79. **Claims 22, 23 and 29** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Davis et al. (*Macromolecules*) as applied to **Claims 1, 8 and 16** above, and further in view of Umek et al. (*Chem. Mater.*).

80. The aforementioned applied art does not disclose the superacid solvent further comprising a radical source (**Claims 22 and 29**) selected from 2,2'-*azo-bis*-isobutyrylnitrile, benzoyl peroxide, di-tert-butylperoxide, and combinations thereof (**Claim 23**).

81. With regard to **Claims 22, 23 and 29**, Umek is applied as above.

82. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to modify the process of the aforementioned applied art with the carbon radical source of Umek in order to obtain a process capable of producing functionalized single-wall carbon nanotubes which exhibit better dispersability in organic solvents and thus, easier incorporation into polymer matrices (Umek, page 4755, 2nd column, 2nd paragraph, in particular).

83. **Claim 26** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bahr et al. (*Chem. Mater.*) in view of Davis et al. (*Macromolecules*) and Shibuta (US 5,853,877) as applied to **Claim 25** above, and further in view of Smalley et al. (US 2002/0127171 A1).

84. With regard to **Claim 26**, Bahr is applied as above.

85. With regard to **Claim 26**, Shibuta is applied as above.

86. The aforementioned applied art does not disclose the washing solvent being acetone (**Claim 26**).

87. With regard to **Claim 26**, acetone is a well-known ketone useful in washing single-wall carbon nanotubes, as evidenced by Smalley et al. (US 2002/0127171 A1) (Smalley et al. (US 2002/0127171 A1), paragraph 0040, in particular).

88. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to try to modify the process disclosed by the aforementioned applied art with the acetone washing solvent as taught by Smalley et al. (US 2002/0127171 A1) because one of ordinary skill in the art could have pursued the known potential ketone solvent options within his or her technical grasp with a reasonable expectation of success.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422

F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-3, 5, 7-10, 15, 16, 24, 28 and 32 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1-5, 8, 11-20, 22 and 25 of U.S. Patent No. 7,459,137. Although the conflicting claims are not identical, they are not patentably distinct from each other because U.S. Patent No. 7,459,137 discloses a method for functionalizing carbon nanotubes comprising mixing (dispersing) carbon nanotubes in an acid selected from the group consisting of sulfuric acid, acetic acid, hydrochloric acid, nitric acid, phosphoric acid, toluenesulphonic acid, trifluoroacetic acid, and combinations thereof; and b) functionalizing the carbon nanotubes using a functionalizing agent while the carbon nanotubes are mixed in the solvent; wherein functionalizing comprises attaching functional groups to the sidewalls to form sidewall functionalized carbon nanotubes, substantially as in the instant application. While **Claim 1** of U.S. Patent No. 7,459,137 does recite “reacting said

plurality of carbon nanotubes at the sidewall carbon atoms with an organic functionalizing agent in the absence of a solvent," the organic functionalizing agent is further limited to "a reactive diazonium specie" (**Claim 11**) generated from an aryl diazonium salt (**Claim 12**), wherein the diazonium specie is generated in situ from an aniline derivative and an inorganic nitrite in the presence of an acid (**Claim 20**) selected from the group consisting of sulfuric acid, acetic acid, hydrochloric acid, nitric acid, phosphoric acid, toluenesulphonic acid, trifluoroacetic acid, and combinations thereof (**Claim 22**). Thus, if the carbon nanotubes of U.S. Patent No. 7,459,137 are sidewall functionalized using a functionalizing agent in the presence of an acid (**Claim 20**) selected from the group consisting of sulfuric acid, acetic acid, hydrochloric acid, nitric acid, phosphoric acid, toluenesulphonic acid, trifluoroacetic acid, and combinations thereof, calling the acid a "solvent" is a matter of semantics. The oxoacid of U.S. Patent No. 7,459,137 would be an "acid solvent" that disperses the carbon nanotubes to no less an extent than that of the instant application.

Claims 1-3, 5, 7-10, 15, 16, 20, 24, 28 and 30-32 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1-6, 11, 12, 14, 15, 18, 21, 22 and 29 of U.S. Patent No. 7,250,147 in view of Smalley et al. (WO 03/004741 A1).

89. U.S. Patent No. 7,250,147 discloses dispersing single-wall carbon nanotubes in a solvent; adding a functionalizing agent (diazonium salt or diazonium generated in situ by reacting an alkyl nitrite with an aniline derivative) to the solution; and functionalizing

the dispersed single-wall carbon nanotubes using the added functionalizing agent while the dispersed single-wall carbon nanotubes are in the solution; wherein the functionalizing comprises covalently attaching the added functionalizing agent to the sidewalls of the single-wall carbon nanotubes to form sidewall functionalized carbon nanotubes. The difference between the process of U.S. Patent No. 7,250,147 and that of **Claim 1** is U.S. Patent No. 7,250,147 does not disclose an acid solvent selected from the group consisting of a superacid and an oxoacid further comprising a persulfate species. The difference between the process of U.S. Patent No. 7,250,147 and that of **Claim 16** is U.S. Patent No. 7,250,147 does not disclose a superacid solvent.

90. With regard to **Claims 1 and 16**, Smalley is applied as above.

91. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to modify the process of U.S. Patent No. 7,250,147 with the superacid solvent of Smalley in order to overcome the well-known difficulties in single-wall carbon nanotube dispersion (Smalley, page 2, in particular) and to obtain a process with enhanced single-wall carbon nanotube dispersion (Smalley, Abstract; page 12, lines 6-13, in particular).

Response to Amendment

Applicants' amendments with regard to the Specification, Claims and Drawings, filed February 4, 2011, have been fully considered and are accepted. The Objections to the Drawings of the previous Office action have been withdrawn.

Response to Arguments

Applicants' arguments filed February 4, 2011, with respect to Cooper, Dyke, Csuzdi and Khabashesku (Applicants' Response, 2/4/2011, pages 10-23) have been considered but are moot in view of the new grounds of rejection.

Applicants' arguments filed February 4, 2011, with respect to Niu, Davis, Yu and Bahr (Applicants' Response, 2/4/2011, pages 10-23) have been fully considered but they are not persuasive. In response to Applicants' arguments against the references individually (Applicants' Response, 2/4/2011, pages 10-23), one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Niu

Applicants' argument that "Niu does not teach or suggest methods of functionalizing carbon nanotubes while the carbon nanotubes are dispersed in an acid solvent through the covalent attachment of added functionalizing agents to the dispersed carbon nanotube solution" (Applicants' Response, 2/4/2011, pages 13, 16, 17 and 22) is not convincing because Niu was not used to teach such limitations. Niu was

used for the teaching that a persulfate species can be used in a carbon nanotube dispersion to increase the degree of dispersion of carbon nanotubes and aid in disassembling carbon nanotube aggregates (Niu, Abstract, in particular).

Applicants' argument that Niu teaches away from the use of the claimed acid solvents because Niu disclaims the use of such acids via the teaching that "[t]he use of strong acid such as nitric acid and sulfuric acid leads to corrosion problems" (Applicants' Response, 2/4/2011, pages 13, 16, 17 and 22) is not convincing because Niu does teach use of a persulfate species with sulfuric acid (Niu, Example 18, in particular).

Davis

Applicants' argument that "Davis does not teach or suggest methods of functionalizing carbon nanotubes while the carbon nanotubes are dispersed in an acid solvent through the covalent attachment of added functionalizing agents to the dispersed carbon nanotube solution" because "Davis is entirely silent on any methods for functionalizing carbon nanotubes by added functionalizing agents" and "Applicants are unaware of any teachings or suggestions in Davis that pertain to the functionalization of carbon nanotubes by added functionalizing agents" (Applicants' Response, 2/4/2011, pages 15-23) is not convincing. Davis was not used to teach functionalizing carbon nanotubes by added functionalizing agents. Rather, Davis was used for the teaching that single-walled carbon nanotubes can be dispersed at high concentrations in superacids such as oleum, chlorosulfonic acid, triflic acid, sulfuric acid, and combinations thereof (Davis, Abstract; page 154; page 159, "Conclusions," in particular).

In response to Applicants' argument that "Davis deviated from the goals and approaches of the present invention" because "Davis merely focused on designing and optimizing a process for forming macroscopic objects for studying phase behavior and rheology of SWNTs" and "[t]hus, it is not clear how such phase behavior and rheology studies would have required the functionalization of carbon nanotubes dispersed in acid solvents by added functionalizing agents" (Applicants' Response, 2/4/2011, pages 16-23), the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Even if "the authors in Davis did not have any desire or motivation to functionalize carbon nanotubes" (Applicants' Response, 2/4/2011, pages 16-23), said authors' desire or motivation is irrelevant here. Davis was used only for the teaching that single-walled carbon nanotubes can be dispersed at high concentrations in superacids such as oleum, chlorosulfonic acid, triflic acid, sulfuric acid, and combinations thereof (Davis, Abstract; page 154; page 159, "Conclusions," in particular). A teaching by Davis of functionalizing carbon nanotubes by added functionalizing agents is not necessary where, as here, there is another motivation to combine Davis with the applied prior art. It would have been obvious to one of ordinary skill in the art at the time of invention to modify the process of Bahr with the superacid of Davis in order to obtain a process capable of achieving a high concentration of

dispersed carbon nanotubes (Davis, Abstract; page 154, 1st column – 2nd column, 1st paragraph, in particular).

Yu

Applicants' arguments that "Yu fails to teach or suggest any type of carbon nanotube dispersion in any type of superacid solvent" and "fails to teach or suggest any type of carbon nanotube functionalization" because "independent word searches for 'nanotube', 'functionalize' and 'functionalization' in Yu yielded no results" (Applicants' Response, 2/4/2011, pages 19, 22 and 23) is not convincing. The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Yu was only used for the teaching that sulfanilic acid is a well-known aniline species used to produce diazonium species (Yu, Examples, in particular).

Bahr

Applicants' argument that "it is not clear how Bahr could teach or suggest any methods of functionalizing carbon nanotubes while the carbon nanotubes are dispersed in an acid solvent through the covalent attachment of added functionalizing agents to the dispersed carbon nanotube solution" if "Bahr does *not* disclose *an acid solvent,* the carbon nanotubes having substantially exposed sidewalls, or the *functionalizing* comprising *covalently* attaching functional groups to the substantially exposed

sidewalls" (Applicants' Response, 2/4/2011, pages 20-23) is not convincing. Applicants' argument that "Bahr deviated from the claimed invention" because "[a]ny acid treatment of carbon nanotubes in Bahr constituted stirring in hydrochloric acid, not dispersion in superacids and oxoacids further comprising a persulfate species" and "any subsequent functionalization steps after acid treatment in Bahr occurred after the acid-treated carbon nanotubes were 'washed with *copious* amounts of water, then with 10% aqueous sodium bicarbonate, and finally with *additional water*'" (Applicants' Response, 2/4/2011, page 21) is not convincing. The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Bahr was not used to teach the use of the claimed acid solvent. It would have been obvious to one of ordinary skill in the art at the time of invention to modify the process of Bahr with the superacid of Davis in order to obtain a process capable of achieving a high concentration of dispersed carbon nanotubes (Davis, Abstract; page 154, 1st column – 2nd column, 1st paragraph, in particular).

In response to Applicants' argument that the examiner's "mere conclusory statement [that "it would have been obvious to one of ordinary skill in the art to modify the process of Bahr with the superacid of Davis in order to obtain a high concentration of dispersed carbon nanotubes"] does not establish *a prima facie* case of obviousness"

(Applicants' Response, 2/4/2011, page 21), the fact that Applicants have recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). It is well-known in the art that high and uniform concentration carbon nanotube dispersions are desirable, and Davis provides a method of achieving such desirable outcome.

In response to Applicants' argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning (Applicants' Response, 2/4/2011, page 21), it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the Applicants' disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). "[T[he fact that the authors in Davis did not have any desire or motivation to functionalize carbon nanotubes" (Applicants' Response, 2/4/2011, page 21) is irrelevant here. The fact that Applicants have recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Applicants' arguments filed February 4, 2011, with respect to the obviousness-type double patenting rejection over U.S. Pat. No. 7,459,137 (Applicants' Response, 2/4/2011, page 23) have been fully considered but they are not persuasive. Applicants'

argument that Claims 1-5, 11, 20 and 25 of U.S. Pat. No. 7,459,137 "fail the one-way obviousness test under M.P.E.P. §804 due to their silence on the functionalization of carbon nanotubes by added functionalizing agents while the carbon nanotubes are dispersed in superacids and/or acid solvents" (Applicants' Response, 2/4/2011, page 23) is not convincing. Claim 20 of U.S. Pat. No. 7,459,137 recites "the diazonium species is generated in situ from an aniline derivative and an inorganic nitrite in the presence of an acid." Claim 1 of U.S. Pat. No. 7,459,137 recites "reacting said plurality of carbon nanotubes at the sidewall carbon atoms with an organic functionalizing agent." Claim 22 of U.S. Pat. No. 7,459,137 recites the acid is selected from the group consisting of sulfuric acid, acetic acid, hydrochloric acid, nitric acid, phosphoric acid, toluenesulphonic acid, trifluoroacetic acid, and combinations thereof. Thus, in view of Claims 1, 20 and 22 of U.S. Pat. No. 7,459,137, the plurality of carbon nanotubes would be reacted at the sidewall carbon atoms with the diazonium species generated in situ from an aniline derivative and an inorganic nitrite in the presence of an acid selected from the group consisting of sulfuric acid, acetic acid, hydrochloric acid, nitric acid, phosphoric acid, toluenesulphonic acid, trifluoroacetic acid, and combinations thereof. This would suggest the functionalization of the carbon nanotubes by added functionalizing agents while the carbon nanotubes are dispersed in superacids and/or acid solvents.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRITTANY M. MARTINEZ whose telephone number is (571) 270-3586. The examiner can normally be reached on Monday-Friday 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Emily M. Le can be reached on (571) 272-0903. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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